The case for a strong Polar Code

Friends of the Earth

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I. Introduction[1]

The International Maritime Organization (IMO) — a United Nations specialized body charged with crafting global standards for international shipping — has undertaken the development of a suite of mandatory environmental and safety rules, or "Polar Code," for Arctic and Antarctic shipping. This report asserts that the shipping industry and IMO member nations with an interest in Arctic shipping should support the enactment of a Polar Code with strong safety and environmental provisions. Namely, the Code should, *inter alia*, 1) contain stringent ice strengthening requirements for vessels plying polar waters; and 2) prohibit the use of heavy fuel oil by vessels operating in Arctic waters.[2] A robust Code would serve to harmonize polar shipping rules; aid investment decision-making pertaining to Arctic shipping; ensure environmental protection and foster sustainable development in the region; and avoid the likely overhaul of the Code in the event of a major oil spill.[3]

II. Polar Code background and environmental regulatory gaps for Arctic shipping

The development of specialized rules for polar shipping began in the early 1990s.[4] However, it was not until 2002 that the IMO approved voluntary guidance for Arctic shipping.[5] By 2010, at the urging of Antarctic Treaty members, the IMO finally included the Southern Ocean in the voluntary scheme.[6] Nevertheless, even before the polar shipping guidelines were finalized, IMO member states were pressing for a mandatory set of rules for the Polar Regions,[7] and in 2009 the Organization's Maritime Safety Committee tasked the Design and Equipment Subcommittee with coordinating development of a mandatory Polar Code.[8]

Despite similar ecological features and vulnerabilities, Antarctic waters currently enjoy a plethora of environmental protections not granted to the Arctic Ocean and its peripheral seas. For example, the IMO designated the waters south of 60 degrees south latitude as an Antarctic Special Area[9] under MARPOL 73/78[10] for Annex I (oil),[11] Annex II (noxious liquids)[12] and Annex V (garbage).[13] In addition, a recent amendment to

1 This report was prepared primarily by Friends of the Earth U.S., with contributions from World Wildlife Fund U.S. and the Clean Air Task Force.

2 A ban on use and carriage of heavy-grade oil already applies to Antarctic waters. *See infra* note 14.

3 In this report, use of the term "oil spill" not only refers to spills from oil cargo but also from fuel oil, such as heavy fuel oil, stored in bunker tanks aboard vessels.

4 L. Brigham, *The emerging International Polar Navigation Code: bi-polar relevance,* 248, *in* Protecting the Polar Marine Environment: Law and Policy for Pollution Prevention, D. Vidas (ed.), Cambridge Univ. Press, Cambridge, U.K., 2000.

5 Guidelines for Ships Operating in Arctic Ice-Covered Waters, MSC/. Circ 1056 MEPC/Circ 399 (23 December 2002).

6 Guidelines for Ships Operating in Polar Waters, Resolution A.1024(26) (18 January 2010).

7 *See* MEPC 59/20/1 and MSC 86/23/9 by Denmark, Norway, and the United States.

8 *See* MSC 86/26, Report of the Maritime Safety Committee on its Eighty-Sixth Session, by the Secretariat.

9 Special Areas are certain waters that require, for technical reasons relating to their oceanographical and ecological condition and to their sea traffic, the adoption of special mandatory methods for the prevention of sea pollution. *Available at* http://www.imo.org/OurWork/Environment/PollutionPrevention/SpecialAreasUnderMARPOL/Pages/Default.aspx.

10 International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978, entered into force on Oct. 2, 1983 [hereinafter MARPOL]. The MARPOL Convention contains six annexes pertaining to vessel waste streams. The three annexes not mentioned in the text include: harmful substances in packaged form (Annex III), sewage (Annex IV), and air emissions (Annex VI).

11 MARPOL Annex I, Regulation 15(b)(4), entered into force on Oct. 2, 1983.

12 MARPOL Annex II, Regulation 13(8), entered into force on Oct. 2, 1983.

13 MARPOL Annex V, Regulation 5(2), entered into force on Dec. 31, 1988.

MARPOL Annex I now prohibits the carriage and use of heavy fuel oils in Antarctic waters.[14] Moreover, the Antarctic Treaty System environmental standards (e.g., Protocol on Environmental Protection to the Antarctic Treaty) for vessel wastewater and garbage (including food waste) discharge exceed those for the Arctic region.[15] The Polar Code, thus, presents an excellent opportunity to establish comparable environmental rules with respect to shipping in the Antarctic and Arctic Oceans.

III. Loss of Arctic sea ice

The effects of climate change are nowhere more apparent than in the Arctic. Temperatures in the region have risen at almost twice the rate of the rest of the world,[16] and may climb another four to seven degrees Celsius during this century.[17] Warming is responsible for the alarming loss of about 37,500 km^2 of sea ice every year — an area the size of West Virginia in the United States.[18] Further, the lowest Arctic summer sea ice measurements since 1979 (the advent of satellite recordings), and likely much beyond that, have occurred between 2007 and 2011.[19] And sea ice cover in 2011 nearly eclipsed the record low experienced in 2007 (4.16 million km^2),[20] and was more than 2.5 million km^2 below the 1979 to 2000 average. Arctic sea ice thickness and multi-year ice extent[21] also are declining.[22]

IV. Arctic shipping lanes are opening up and increasing risk of accidents and spills

The disappearance of large amounts of sea ice in summer has opened up shipping lanes in the Arctic. The legendary Northern Sea Route[23] along the Russian Arctic and the Northwest Passage[24] through the Canadian Arctic were both open for the first time in 2008,[25] and have been seasonally clear, on occasion, since then. Sailing distances between Europe and Asia can be considerably less when using an Arctic route as opposed to traditional routes.[26] A voyage along the NSR between Yokohama, Japan and Rotterdam, Netherlands is 40 percent shorter than transiting through Suez Canal.[27] And, likewise, a voyage from Seattle, Washington to Europe through the Northwest Passage would be 25 percent shorter than one using the Panama Canal.[28]

14 MARPOL Annex I, Regulation 43.

15 Protocol on Environmental Protection to the Antarctic Treaty, Annex IV, Arts. 5, 6 (1991), entered into force on Jan. 14, 1998.

16 Intergovernmental Panel on Climate Change, Observations: Surface and Atmospheric Climate Change, *in Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report,* 237 (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter3.pdf.

17 Arctic Climate Impact Assessment, *Impacts of a Warming Arctic,* 10, 12 (2004), *available at* http://amap.no/acia/.

18 From 1979-2006, there was an average decline of 23,328 square miles in the extent of summer sea ice cover each year. *See* 73 Fed. Reg. 28,212, 28,220 (May 15, 2008).

19 R. Black, *Arctic sea routes open as ice melts,* BBC NEWS (U.K.), Aug. 25, 2011, *available at* http://www.bbc.co.uk/news/science-environment-14670433.

20 National Snow and Ice Data Center, *Media Advisory: Arctic sea ice reaches lowest extent for 2011*, Sept. 15, 2011, *available at* http://nsidc.org/news/press/20110915_minimum.html.

21 Multi-year ice is ice that has survived at least two summers' melt. Definition *available at* http://www.tc.gc.ca/eng/marinesafety/debs-arctic-resources-references-ice-terms-2015.htm.

22 Arctic Council, Arctic Marine Shipping Assessment 2009 Report, 25 (2009), *available at* http://arcticportal.org/en/pame/amsa-2009-report [hereinafter AMSA]; R. Lindsay & J. Zhang, *The Thinning of Arctic Sea Ice, 1988–2003: Have We Passed a Tipping Point?*, 18 J. of Climate 4879 (2005); Associated Press, *Arctic is Seeing Thinner Sea Ice, Experts Warn*, MSNBC.COM, April 6, 2009, *available at* http://www.msnbc.msn.com/id/30074699/ (finding that 90 percent of Arctic sea ice is only one to two years old); "The average ice thickness in parts of the central Arctic Ocean has decreased from 3.1 meters to 1.8 meters since 1976." Focus North, *The Environment and Marine Transport,* by OceanFutures for the Norwegian Atlantic Committee, No. 4, 2006.

23 Russia defines the Northern Sea Route as spanning the northern point of Novaya Zemlya and its straits in the west to the Bering Strait in the east. Since it is not one single sailing channel, its length varies from 2,200 to 2,900 miles. D. Brubaker, *Regulation of navigation and vessel-source pollution in the Northern Sea Route: Article 234 and state practice*, 221, *in* Protecting the Polar Marine Environment: Law and Policy for Pollution Prevention, D. Vidas (ed.), University of Cambridge Press, Cambridge, U.K. (2000). The Northeast Passage encompasses the Northern Sea Route and extends through the Barents Sea and Norwegian Sea to connect the Pacific and Atlantic Oceans.

24 The Northwest Passage comprises five recognized routes, with variations, between the Atlantic and Pacific Oceans through the Canadian Arctic Archipelago. AMSA, *supra* note 22, at 20.

25 A. Revkin, *Arctic Ice Hints at Warming, Specialists Say*, NY TIMES, September 6, 2008, *available at* http://www.nytimes.com/2008/09/07/science/earth/07arctic.html?_r=4&scp=2&sq=northwest%20passage&st=cse&oref=slogin.

26 U.S. Coast Guard, "Distance" and "Depth and Width" worksheet, *from* Bering Strait Access Workshop, Institute of the North, Aug. 15, 2011, *available at* http://www.institutenorth.org/calendar/events/bering-strait-access-workshop/.

27 Denmark, Greenland and the Faroe Islands: Kingdom of Denmark Strategy for the Arctic 2011-2020 (19) (2011), *available at* http://www.arcticportal.com/news/arctic-portal-news/denmark-releases-arctic-strategy [hereinafter Kingdom Strategy]; A. Kramer, *Warming Revives Dream of Sea Route in Russian Arctic,* NY TIMES, Oct. 17, 2011, *available at* http://www.nytimes.com/2011/10/18/business/global/warming-revives-old-dream-of-sea-route-in-russian-arctic.html?_r=1. (voyaging from Rotterdam to Yokohama, Japan, via the Northeast Passage, is about 4,450 miles shorter than a route through the Suez Canal).

28 Kingdom Strategy, *supra* note 27, at 19.

Many predictions, based on modelled data, have been offered as to when the Arctic will be essentially ice free in the summer months. Only a few years ago, models projected that summer Arctic sea ice would not disappear until the latter part or end of this century.[29] Those projections have been altered substantially, with many scientists now positing that the Arctic Ocean will be virtually ice free during the summer in 30 to 40 years.[30] Scientists James Overland, U.S. National Oceanic and Atmospheric Administration, and Walt Meier, National Snow and Ice Data Center, believe that an essentially ice-free Arctic will occur between 2030 and 2040,[31] and some scientists theorize that an open Arctic will occur even earlier.[32] According to Overland, "[T]he melting is happening faster in the real world than it has in the models[.]"[33]

The trajectory of an increasingly ice-free Arctic is clear. In light of this profound historical development, shipping lines and cargo owners seeking to capitalize on perceived economic opportunities are preparing to ramp up operations in the region. Presently, about 3,000 vessels operate in the Arctic,[34] making some 15,000 voyages annually.[35] The number of vessels navigating within the region is expected to rise by 2020 and beyond.[36]

V. Drivers of shipping growth

The diminishing state of summer sea ice and the presence of substantial amounts of natural resources are key drivers in the expected growth of Arctic shipping. While uncertainties exist about the precise level of shipping projected to occur, it will likely be significant. Already, the shipping industry is gearing up for expanded activities in the region by purchasing ice-strengthened vessels, investing in infrastructure, and engaging in demonstration voyages. In the near- to mid-term, shipping related to oil and gas exploration and recovery is anticipated to be the fastest growing type of Arctic shipping.[37] One study concludes that new oil and gas production will be in Arctic areas that require more ship transport than pipeline conveyance, increasing oil and gas vessel activity.[38] Greater cruise ship activity in the Arctic will likely occur as well.[39] Recent traffic volume through the NSR has also exceeded expectations, and its growth in the medium- to long-term is envisioned to be substantial.[40]

29 AMSA, *supra* note 22, at 25.

30 The Arctic Council's Arctic Monitoring and Assessment Program released a report in May finding that Arctic sea ice cover is shrinking faster than projected by the U.N.'s expert panel on climate change. The report hypothesizes that the Arctic Ocean will be virtually free of ice in summer within 30 to 40 years. Kramer, *supra* note 27; *see* J.C. Stroeve et al., *Arctic sea ice decline: Faster than forecast,* 34 Geo. Res. Lets. L09501 (2007); AMSA, *supra* note 22, at 25.

31 S. Borenstein, *Arctic sea ice shrinks to second-lowest level,* ASSOCIATED PRESS, Sept. 15, 2011, *available at* http://www.news-record.com/content/2011/09/15/article/arctic_sea_ice_shrinks_to_second_lowest_level; *see* AMSA, *supra* note 22, at 25.

32 N. Collins, *Sea ice to 'melt by 2015'*, THE TELEGRAPH (U.K.), Nov. 8, 2011, *available at* http://www.telegraph.co.uk/earth/environment/globalwarming/8877491/Arctic-sea-ice-to-melt-by-2015.html.

33 B. Walsh, *Farewell to the Arctic—as We Know It*, TIME, Sept. 27, 2011, *available at* http://www.time.com/time/health/article/0,8599,2095114,00.html.

34 AMSA, *supra* note 22, at 72.

35 J. Corbett et al., *An assessment of technologies for reducing regional short-lived climate forcers emitted by ships with implications for Arctic shipping*, 1 Carbon Management 207 (2010) at 208, *in* Clean Shipping Coalition, *New assessment of technologies to reduce emissions of black carbon from international shipping*, (May 6, 2011) (submitted to IMO's Marine Environment Protection Committee and reviewed as MEPC 62/INF.33).

36 *E.g.,* J. Corbett et al., *Arctic shipping emissions inventories and future scenarios*, 10 Atmos. Chem. and Phys. 9689 (2010), *in* Clean Shipping Coalition, *Emissions inventory and analysis of impacts of short-lived climate forcing aerosols from international shipping activity in the Arctic*, (Dec. 10, 2010) (submitted to IMO's Bulk Liquids and Gases Subcommittee and reviewed as BLG 15/INF.5) [hereinafter Arctic Emissions Inventory].

37 According to DNV, 19 of 26 oil and gas tankers over 5,000 gt navigating in the Arctic use heavy fuel oil. Det Norske Veritas (DNV), Report – Heavy fuel in the Arctic (Phase 1), Report for PAME, Report No./ DNV Reg. No.: 2011-0053/ 12RJ7IW-4, 30 (2011), *available at* http://www.arctic-council.org/index.php/en/about/documents/category/26-pame-nuuk-ministerial.

38 G. Peters et al., *Future Emissions from Shipping and Petroleum Activities in the Arctic*, 11 Atmos. Chem. Phys. 5305 (2011).

39 *See* AMSA, *supra* note 22, at 79.

40 Y. Ivanov and E. Longvinovich, *Prospects for Marine Export of Russian Oil, Gas and Other Cargoes via the Northern Sea Route and the Northern Maritime Corridor*, 5, Focus North, 4-2008, *available at* http://www.atlanterhavskomiteen.no/files/atlanterhavskomiteen.no/Publikasjoner/Fokus%20Nord/FN%204-2008.pdf (asserting that near-term vessel traffic is not expected to exceed 500,000 metric tons). However, ships carried 757,400 metric tons of freight – mostly iron ore, natural gas, and fish products – through the NSR in 2011, which was open for a record 141 days. The Russian Federation anticipates that 59 million metric tons will pass through the NSR in 2020, with an additional thirty percent increase in volume by 2030. P. Watson, *Canada well behind Russia in race to claim Arctic seaways and territory*, THE STAR (CAN), Dec. 22, 2011, *available at* http://www.thestar.com/news/world/article/1105612--canada-well-behind-russia-in-race-to-claim-arctic-seaways-and-territory.

A. Shipping associated with natural resource exploration, recovery and transport

1. *Oil and gas development*

The U.S. Geological Survey estimates that about 30 percent of the world's undiscovered gas and 13 percent of the world's undiscovered oil are located in the Arctic.[41] This translates into about 90 billion barrels of oil, nearly 47 trillion cubic meters of natural gas,[42] and 44 billion barrels of natural gas liquids.[43] Importantly, most of the seabed oil and gas resources of the region are located within the Exclusive Economic Zones (EEZs) of the Arctic coastal states — Russian Federation, Canada, Greenland (Denmark), Norway, and the United States[44] — meaning that clearly defined sovereign authority exists over seabed resources within those bounds, and also that coastal and port State control over shipping in EEZs, as opposed to the high seas (waters beyond EEZ boundaries), are greater.[45]

Oil and natural gas deposits in the western Arctic are considered substantial. The Chukchi and Beaufort Sea deposits may hold 25 billion barrels of oil, with a value of $2.4 trillion based average oil prices (NY Mercantile Exchange) in 2011.[46] Exploration drilling on the Alaska outer continental shelf is proposed for 2012 and could result in actual production activities by around 2020. In 2012 and 2013, Shell intends to drill as many as three exploration wells in the Chukchi Sea[47] using the *Noble Discoverer* drillship and up to two exploration wells in the Beaufort Sea deploying the *Kulluk* drillship.[48] For these drilling operations, Shell expects to use additional vessels for fleet fuel supply, tug support, waste and cuttings capture, standby oil spill response, shuttling to the dock, and supply duties.[49] In addition, ConocoPhillips and Statoil also plan to conduct exploratory drilling in the Chukchi Sea in the next few years.[50]

Experts estimate that 31 billion barrels of oil and gas reside off Greenland's northeast coast, with 12 billion barrels located off of the country's west coast. By January 2011 there were 20 active licenses for exploration and recovery of oil and gas in Greenlandic waters, and more licenses are expected as a new licensing round for northeast Greenland is set for 2012-2013.[51]

Although Canada presently has no oil and gas drilling operations in the Beaufort Sea, several major energy companies have invested billions of dollars and are committed to spending millions more on oil and gas exploration in its offshore waters over the next decade.[52]

41 *See* U.S. Dep't of Interior, U.S. Geological Survey, Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle, USGS Fact Sheet 2008-3049 (2008); Press Release, U.S. Dep't of Interior, U.S. Geological Survey, 90 Billion Barrels of Oil and 1,670 Trillion Cubic Feet of Natural Gas Assessed in the Arctic (July 23, 2008), *available at* http://www.usgs.gov/newsroom/article.asp?ID=1980.

42 USGS estimates that 85 trillion cubic feet of undiscovered, technically recoverable gas hydrates are in the Arctic. *See Id.* Increased Arctic shipping also may be associated with gas hydrate exploration and production. Russia's Messoyakha gas hydrate field, located in the West Siberian Basin, illustrates that gas hydrates are not only technically recoverable, but also can be economically viable. *See, e.g.*, T. Collett, *Gas Hydrates as a Future Energy Resource*, GEOTIMES, Nov. 2004, *available at* http://www.geotimes.org/nov04/feature_futurehydrates.html.

43 U.S. Geological Survey Fact Sheet, *supra* note 41.

44 AMSA, *supra* note 22, at 98.

45 *See generally* D. Rothwell and C. Joyner, *Domestic perspectives and regulations in protecting the polar marine environment: Australia, Canada and the United States, in* Protecting the Polar Marine Environment: Law and Policy for Pollution Prevention, D. Vidas (ed.), University of Cambridge Press, Cambridge, U.K. (2000); L. Johnson, Coastal State Regulation of International Shipping, Oceana Publications, Inc., Dobbs Ferry, New York, U.S.A. (2004).

46 K. Klimasinska, *Alaska to BP to Conoco Count On Shell Arctic Bounty*, BLOOMBERG, Oct. 1, 2011, *available at* http://www.businessweek.com/news/2011-10-01/alaska-to-bp-to-conoco-count-on-shell-arctic-bounty.html.

47 K. Klimasinska, *U.S. Affirms Shell, Statoil Arctic Oil-Lease Purchases*, BLOOMBERG, Oct. 3, 2011, *available at* http://www.businessweek.com/news/2011-10-03/u-s-affirms-shell-statoil-arctic-oil-lease-purchases.html#0_undefined,0_.

48 A. Bailey, *Shell plans to drill in Beaufort and Chukchi seas in 2012-13,* 16 Petroleum News 11, *available at* http://www.petroleumnews.com/pntruncate/91575565.shtml; for an updated status on Shell's current oil and gas leasing activities in the outer continental shelf of the Beaufort and Chukchi Seas, *see* BOEMRE's website at http://www.alaska.boemre.gov/cproject/CPROJECT.HTM.

49 *See* Shell Offshore Inc, Revised Outer Continental Shelf Lease Exploration Plan, Camden Bay, Beaufort Sea, Alaska (May 2011), at 1-1,1-2, *available at* http://www.alaska.boemre.gov/ref/ProjectHistory/2012Shell_BF/revisedEP/2011_0505_EP.pdf.

50 *See, e.g.,* P. Eppler, Feds: *Arctic Offshore Drilling Preparation Should Be Allowed*, ALASKA DISPATCH, May 6, 2011, *available at* http://www.alaskadispatch.com/article/feds-arctic-offshore-drilling-preparation-should-be-allowed.

51 Kingdom Strategy, *supra* note 27, at 26.

52 *See, e.g.,* G. Park, *Prevention the Best Cure: Canada's Industry Urges Review of Arctic Drilling to Favor New Blowout Technology,* PETROLEUM NEWS, Apr. 17, 2011, *available at* http://www.petroleumnews.com/pntruncate/100046473.shtml; *Ottawa Awards BP $1.2B in Exploration Permits in Beaufort Sea,* CBCNEWS CANADA, June 8, 2008, *available at* http://www.cbc.ca/news/canada/north/story/2008/06/09/beaufort-leases.html.

Operations are set to commence after 2014. Meanwhile, lease sales and seismic activities proceed, along with associated energy and transport planning. With respect to the latter, South Korean natural gas companies recently proposed using LNG tankers to export gas from Canada's Beaufort Sea to Asian markets.[53]

Norway's Snohvit Arctic gas field in the Barents Sea, which began production in 2007, yields 4.2 million tons of natural gas annually for export to the United States and Europe.[54] Statoil, a Norwegian energy company, uses large LNG tankers to transport the hydrocarbons and expects to deploy four of these carriers for at least the next 20 years, exporting about 70 shiploads per year.[55] One tanker, the 118,000 gross ton[56] ice-strengthened *Arctic Discoverer*, made its first trans-Atlantic delivery from Norway's Arctic to Maryland's Cove Point Gas Import Terminal in February 2008.[57]

The Russian Federation also has prodigious natural resource reserves.[58] According to the Russian Institute of Oceanic Studies, the western sector of the Russian Arctic contains about 71 trillion cubic meters of gas and 42 billion tons of oil.[59] Eleven oil and gas deposits have been located in the Barents Sea alone.[60] The Shtokman field in the eastern Barents Sea is estimated to contain four trillion cubic meters of gas and about 56 million metric tons of gas condensate.[61] Liquid natural gas shipments from the field are expected to leave Teriberka Bay, near Murmansk, via tankers to destinations in Europe and North America.[62] Russia also currently uses icebreaking tankers to ship oil from the Pechora Sea to Murmansk, where oil is loaded onto larger tankers for export abroad.[63] In addition, Exxon Mobil recently entered into an agreement with Rosneft, the Russian state oil company, to drill in the Kara Sea.[64] This area contains the Rusanovskoye and Leningradskoye gas fields, believed to each hold three trillion cubic meters,[65] and gas deposits in Taz Bay and the Gulf of Ob.[66] The Prirazlomnoye oil field in the eastern part of the Pechora Sea is scheduled to begin production in 2012.[67] The field has oil reserves of 610 million barrels and is expected to produce for 22 years.[68] Two ice-class tankers, the *Kirill Lavrov* and the *Mikhail Ulyanov*, will transfer oil from Prirazlomnoye to a floating platform. The crude oil will then be transported by four 150,000 to 170,000 deadweight ton[69] supertankers.[70]

In light of these vast deposits, Russia and Norway are preparing for expanded shipping in their waters related to oil and gas transport. The Russian state-owned shipping entity Sovcomflot is constructing ice-class tankers for oil and LNG transport with a total capacity of approximately one million deadweight tons.[71] Offshore

53 *See, e.g.,* N. Vanderklippe, *South Koreans Eye Arctic LNG Shipments*, GLOBE AND MAIL (CAN), Apr. 19, 2011, *available at* http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/south-koreans-eye-arctic-lng-shipments/article1991882/.

54 *See* Press Release, "K" Line Europe, Delivery of 140,000 cbm type LNG carrier "Arctic Discoverer" (Feb. 15, 2006), *available at* http://www.kline.co.jp/news/2006/060215_e.htm.

55 *See* Press Release, "K" Line Shipping UK, Snohvit Project, *available at* http://www.klinelnguk.com/klinelng/activities/index.asp?pr=1.

56 Gross tonnage is a unitless index related to a vessel's overall internal volume.

57 *See* Press Release, Statoil, First Cargo of Norwegian Gas to USA (Feb. 22, 2008), *available at* http://www.statoil.com/en/NewsAndMedia/News/2008/Pages/FirstLNGUSA.aspx.

58 Proven and potential reserves in the Russian Arctic are estimated at $15 trillion. Y. Solozobov, *Escalating tensions over hunt for oil and gas in the Arctic,* GLOBALRESEARCH.CA, Aug. 30, 2009, *available at* http://www.globalresearch.ca/index.php?context=va&aid=14970.

59 *How much oil is in the Arctic,* VOICE OF RUSSIA, Nov. 29, 2011, *available at* http://english.ruvr.ru/2011/11/29/61188118.html.

60 *Vast Riches of the Arctic Shelf*, VOICE OF RUSSIA, Nov. 10, 2011, *available at* http://english.ruvr.ru/2011/11/10/60176331.html.

61 *The Shtokman Field,* VOICE OF RUSSIA, Nov. 22, 2011, *available at* http://english.ruvr.ru/2011/11/22/60808237.html.

62 Ivanov and Longvinovich, *supra* note 40, at 4.

63 *See* ConocoPhillips Russia, NaryanmarNeftegas JV, *available at* http://www.conocophillips.ru/EN/project-russia/naryanmarneftegas/Pages/index.aspx; Sovcomflot (SCF) Group, 2010 Audited Results, Apr. 15, 2011, *available at* http://www.scf-group.com/npage.aspx?anim=1&cs=5&cid=113&cs2=1&did=80501.

64 Kramer, *supra* note 27.

65 Solozobov, *supra* note 58.

66 Gazprom, a Russian energy company, estimates the resources of the Kara, Pechora and Barents Seas at approximately 70 billion metric tons of fuel oil equivalent. *See supra* note 59. The Yamal Peninsula–Ob Bay area will require significant shipping activity with respect to infrastructure development and product transport, according to Russian officials. M. Arild and J. Øystein, Opening of New Arctic Shipping Routes, prepared for European Parliament's Committee on Foreign Affairs, (2010), *available at* http://tepsa.be/Arild%20Moe_%C3%98ystein%20JENSEN.pdf.

67 G. Starinskaya, *"Prirazlomnaya" to Launch a "Drilling Campaign" on the Russian Arctic Shelf,* OIL AND GAS EURASIA, Sept. 2011, *available at* http://www.oilandgaseurasia.com/articles/p/146/article/1615/.

68 Prirazlomnoye Oilfield, OFFSHORE-TECHNOLOGY.COM, *available at* http://www.offshore-technology.com/projects/Prirazlomnoye/.

69 Deadweight tonnage is a measure of how much weight a vessel is carrying or can safely carry.

70 Prirazlomnoye Oilfield, *supra* note 68.

71 Ivanov and Longvinovich, *supra* note 40.

development and port expansion plans are also taking place or being considered for many areas of the Russian Arctic, including Murmansk, near Arkhangelsk, Chöshkaya Bay, and Ob Bay.[72]

Natural resource transport along the Northern Sea Route is increasing annually. In 2010, the oil tankers *Indiga* and *Varzuga*, each holding 15,000 metric tons of cargo, voyaged from Murmansk to Chukotka.[73] That summer, the Russian tanker *Baltika*, carrying 70,000 metric tons of gas condensate, traveled from Murmansk to China. The *Baltika* is reported to be the first high-tonnage tanker to attempt the Northeast Passage.[74]

Vessel activity involving natural resources was incrementally greater in 2011. Due to advantageous sea ice conditions in the Kara and Barents seas, the tanker *Perseverence* set sail on June 29, 2011 from Murmansk, Russia, aided by two icebreakers and completed its passage on July 14.[75] The company plans to send six to seven more ships through the Northern Sea Route in 2011.[76] In August 2011, the tanker *Vladimir Tikhonov* — carrying 120,000 metric tons of natural gas condensate — and the tanker *STI Heritage* navigated the route.[77] Two Neste oil tankers, the *Stena Poseidon* and the *MT Palva*, also made the journey.[78] In all, 34 ships have traversed the Russian Arctic sea route in 2011,[79] with nine tankers carrying about 550,000 metric tons of gas condensate.[80]

Oil transport via the NSR is anticipated to increase significantly. In 2008, more than 10 million metric tons of oil were transported through Russia's western Arctic. Further, shipped oil from Russia that passed along the Norwegian coast increased from around four MMT in 2002 to 16.5 MMT in 2009.[81] By 2020, 40 to 45 MMT of oil are expected to be shipped along the NSR, comprising about 70 percent of all NSR traffic.[82] (See Figure 1 on next page, Map of Northern Sea Route).

2. *Other natural resource development*

At five trillion metric tons, Alaska's vast coal resources represent roughly half of the total known U.S. coal reserves.[83] At least eight proposed mines are in the midst of the permitting process.[84] Near Anchorage, the Usibelli's *Wishbone Hill Coal* Mine plans to produce about 450,000 metric tons annually for 12 years, with shipments to Asian markets beginning as early as 2012 from Port MacKenzie.[85] Farther north, vessel traffic related to coal and hard minerals is similarly expected to increase annually, particularly during the summer shipping season, as more mines begin production and existing mines ramp up production by expanding known reserves. Large mines in Alaska currently include Red Dog, located in Northwest Alaska, and Rock Creek on the Seward Peninsula. The Arctic Slope Regional Cor-

72 *Id.*

73 K. Riska, *Challenges and Possibilities in Arctic Marine Operations*, 55, *In* Marine Transport in the High North, J. Grue and R. Gabrielsen (eds.), The Norwegian Academy of Science and Letters and The Norwegian Academy of Technological Sciences, (2011).

74 N. Jameson, *Tanker takes North East Passage to China*, London News Desk, SUSTAINABLESHIPPING.COM, Aug. 18, 2010.

75 The latest Northern Sea Route voyage of the *Perseverence* ended on November 18. 2011, evincing a five-month long navigation period for the route. *See* M. Treadwell, *America is Missing the Boat*, Hearing on Protecting U.S. Sovereignty: Coast Guard Operations in the Arctic, Testimony before the House Committee on Transportation and Infrastructure's Subcommittee on Coast Guard and Maritime Transportation, U.S. House of Representatives, The Honorable Frank LoBiondo, Chair, Dec. 1, 2011, at 2, *available at* http://transportation.house.gov/hearings/hearingdetail.aspx?NewsID=1458.

76 N. Bruckner-Menchelli, *Near record Arctic ice melt opens shipping lanes*, Vancouver News Desk, SUSTAINABLESHIPPING.COM, Aug. 4, 2011.

77 G. Bryanski, *Russia's Putin says Arctic trade route to rival Suez,* REUTERS CANADA, Sept. 22, 2011, *available at* http://ca.reuters.com/article/topNews/idCATRE78L5TC20110922?pageNumber=1&virtualBrandChannel=0.

78 N. Bruckner-Menchelli, *Tankers successfully traverse the Arctic's Northeast Passage*, Vancouver News Desk, SUSTAINABLESHIPPING.COM, Sept. 30, 2011.

79 M. Byers, *Melting Arctic brings new opportunities*, ALJAZEERA, Dec. 22, 2011, *available at* http://www.aljazeera.com/indepth/opinion/2011/12/2011121913304370977.html.

80 Treadwell testimony, *supra* note 75, at 2.

81 Det Norske Veritas (DNV), Shipping Across the Arctic Ocean: A feasible option in 2030-2050 as a result of global warming, Position Paper 04-2010, (2010), *citing* The Norwegian Coastal Administration, 2010.

82 Ivanov and Longvinovich, *supra* note 40; *see also* AMSA, *supra* note 22, at 5.

83 *See* R. Flores et al., Alaska Coal Geology, Resources, and Coalbed Methane Potential, U.S. Geological Survey, (2005), *available at* http://pubs.usgs.gov/dds/dds-077/.

84 For current permits, *see* the Alaska Division of Mining, Land and Water Management website, *available at* http://dnr.alaska.gov/mlw/mining/coal/.

85 *See* Usibelli Coal Mine, Inc., Wishbone Hill Mine (brochure), *available at* http://www.usibelli.com/wishbone-brochure-web.pdf; T. Bradner, *Usibelli May Have Buyer for Wishbone Coal; Plan Tests from MacKenzie*, ALASKA J. OF COMMERCE, June 4, 2010, *available at* http://www.alaskajournal.com/stories/060410/loc_11_002.shtml.

Figure 1: Northern Sea Route

poration, in collaboration with BHP Billiton, recently conducted three years of exploration activities to determine the coal potential between Point Lay and Point Hope just inland of the Chukchi Sea coast. The regional corporation reports that the coal is "world class" and is currently seeking a development company for coal production in the western Arctic.[86]

The potential for energy resource extraction in the Russian Arctic, apart from uranium, surpasses 1,200 billion metric tons of oil equivalent (of which 60 percent is coal and 20 is extractable reserves of natural gas and oil). Kola province holds platinum-group metals, copper-nickel ores, rare-earth metals, iron, phosphorus, diamonds, and gold.[87] And Norilsk Nikel intends to begin exporting coal from Taimyr after 2015.[88] The timber industry also plans to resume shipping operations from several Russian Arctic ports, at up to 1.1 MMT per year. Approximately 15 to 20 new wood-carrying ships will be needed for this expansion.[89]

Greenland's mineral deposits are also exceptional. They include zinc, nickel, copper, diamonds, and gold. The country also possesses rare earth elements, which are integral to the technology sector. Potential world class and multi-commodity ore deposits exist all over coastal Greenland, including the Kvanefjeld Project near the country's southwestern tip. Exploration and recovery of these resources "will require Arctic marine transport systems to carry these scarce commodities to global markets."[90]

In Canada, the Mary River iron ore deposits on Baffin Island, Nunavut are particularly prized, containing iron ore with 67 percent iron.[91] Plans are being considered to develop a mining operation on Baffin and ship about 16.5 million metric tons of ore a year to Europe,

86 Alaska Slope Regional Corporation — Coal, *available at* http://www.asrc.com/Lands/Pages/Coal.aspx.
87 VOICE OF RUSSIA, *supra* note 60.
88 Ivanov and Longvinovich, *supra* note 40, at 4.
89 *Id*.
90 AMSA, *supra* note 22, at 98.
91 *Id*.

for a minimum of 25 years. A fleet of ice-strengthened bulk carriers operating on a year-round basis would be needed for the project.[92]

Norway for years has exploited mineral resources in the Svalbard Islands and other parts of the country. In September 2010, the ice class bulk carrier, *Nordic Barents*, sailed with 37,000 metric tons of iron ore concentrate from northern Norway to China through the Northeast Passage.[93,94]

A Norwegian shipping company, Tschudi, is reviving an idled iron ore mine in the country's north in order to ship ore to China through the Northeast Passage. A voyage in 2010 to Lianyungang, China took 21 days, as opposed to the 37 days normally required to sail to China through the Suez Canal. Tschudi executives assert that the company saves $300,000 per trip.[95]

B. Marine tourism — Cruise ships

Cruise ship activity in Arctic waters is rapidly expanding. In 2004, about 275 passenger ships operated within the region, with cruise ships carrying more than 1.2 million passengers — by 2007, the number of cruise ship passengers had more than doubled.[96] Additional growth in cruise activity in the region is anticipated.[97] As Dr. John Snyder of Strategic Studies, Inc., in the United States notes, developing Arctic tourism is an objective of the Russian Federation, Greenland, Nunavut, Yukon, Manitoba, Sami, and Native Alaskan economies.[98] Cruise ships, as elaborated below, are also visiting higher latitudes of the Arctic. The Arctic Council's authoritative Arctic Marine Shipping Assessment 2009 Report remarks that "[t]his combination of hostile environmental conditions and scarce emergency infrastructure is a serious threat to human life."[99]

Cruise ship activities also pose a distinct threat to the marine environment. The AMSA states that "[c]ruise ships often intentionally travel close to the ice edge and shorelines for wildlife viewing opportunities, increasing the risk of interaction with ice and other hazards."[100] Furthermore, larger passenger ships (those 5,000 gross tons and greater) navigating in the Arctic tend to use heavy fuel oil[101] — 27 out of 28, according to a DNV study.[102] In addition, the number of large passenger ships using HFO is likely understated as the study only viewed Arctic vessel activity for part of the year, from August to November, and its geographic scope was not as expansive as the Arctic Council's AMSA, which identified more than 275 passenger ships (including cruise ships) in the Arctic in 2004.[103]

The AMSA also points out other concerns posed by the cruise sector:

> *From 2000 to the end of 2008, 88 new cruise ships were introduced. The vast majority of these vessels were not constructed or designed to operate in Arctic conditions, yet as Arctic cruise tourism continues grow, it is very likely that many of them may make trips to the region…[104] The cruise ship industry has indicated that it not only intends to maintain an Arctic presence, but to expand in terms of ship passenger capacity, destinations and extended seasons of operations. This will be encouraged by circumpolar nations that consider tourism important for growing and strengthening their economies.[105]*

92 *Id*.
93 Kingdom Strategy, *supra* note 27, at 19.
94 According to DNV, 49 of 49 bulk carriers over 10,000 gt operate on heavy fuel oil while transiting the Arctic. *See* DNV Heavy Fuel Report, *supra* note 37, at 30.
95 Kramer, *supra* note 27.
96 AMSA, *supra* note 22, at 71, 79.
97 *Id*. at 81; *see infra* note 104.
98 Harold Hunt, *Raising the Ante: Mass rescue operations in the Arctic*, USCG Proceedings Magazine 25 (Fall 2011), *available at* http://uscgproceedings.epubxp.com/issue/43475/24/.
99 AMSA, *supra* note 22, at 80.
100 *Id*. at 79.
101 Consistent with DNV Heavy Fuel Report, *see supra* note 37, the term heavy fuel oil in this study denotes residual marine fuel or mixtures containing predominately residual fuel and some distillate fuel, such as intermediate fuel oil.
102 *Id*. at 30.
103 AMSA, *supra* note 22, at 71.
104 AMSA, *supra* note 22, at 79; *see also* M. Lück, *Environmental Impacts of Polar Cruises, in* Cruise Tourism in Polar Regions: Promoting Environmental and Social Sustainability?, Lück et al. (eds.), 110, (2010).
105 AMSA, *supra* note 22, at 79.

Russian cruise ship, *Maxim Gorkiy*, in Norway. Photo credit: Thomas Hallermann/Marine Photobank.

Moreover, most cruise ships with substantial ice capabilities are approaching the end of their expected service lives, leaving behind a fleet of less ice-equipped passenger vessels, which further buttresses the need for appropriate Arctic operhards.[106]

This confluence of circumstances, as well as a recent cruise ship grounding in the Canadian Arctic,[107] puts into stark relief the need to have cruise ships adequately ice-strengthened for Arctic duty. As well, it underscores that cruise ships should not be using HFO while in the region.

106 I. Brosnan, *The diminishing age gap between polar cruisers and their ships: A new reason to codify the IMO Guidelines for ships operating in polar waters and make them mandatory?*, 35 Marine Policy 261 (2011).

107 In August 2010, the expedition cruise ship *Clipper Adventurer* stranded itself on an escarpment in Coronation Gulf. *See supra* note 113.

1. Greenland

Fourteen cruise ships visited Greenland a total of 164 times in 2003. In 2010, 43 cruise ships berthed in Greenland ports, compared to 32 the year before,[108] revealing more than 200 percent growth in this sector in only eight years.[109] Moreover, these cruise ships are venturing into new territory. In 2008, 28 vessels planned to travel to Uummannaq, Greenland, with some continuing northward to Qaanaaq — both locations are far north of the Arctic Circle.[110]

108 Kingdom Strategy, *supra* note 27, at 16.

109 AMSA, *supra* note 22, at 79.

110 *Id*. at 81.

2. *Canada*

Within Arctic Canada,[111] planned cruise itineraries doubled between 2005 and 2006 to 22 and have increased at a rate of 9.5 percent on average over the subsequent four years.[112] While traffic has dissipated somewhat of late due to the recent global financial downturn and scuttling of the Inuit-operated *Lyubov Orlova*,[113] cruise ship activity in the Arctic waters of Canada is expected to grow in the future.[114] Interestingly, a marked shift has occurred in cruise ship travel within the Canadian Arctic. Community and shore landings by cruise ships to the High Arctic and Northwest Passage have increased 63 percent and 57 percent, respectively, from 2006 to 2010, whereas voyages to lower Arctic latitude destinations including Baffin Bay, Hudson Bay, and Newfoundland have tapered off.[115] Voyages to the upper reaches of the Arctic potentially present a greater risk of harm to ships because of the presence of higher concentrations of older, harder sea ice and deteriorating ice shelf conditions.[116]

3. *United States and Russia*

Cruise ship activity in the Arctic areas of both countries is fairly limited. In Russia, there are voyages to Franz Josef Land and Novaya Zemlya.[117] And there have been cruise ships sailing through the Northern Sea Route, from Murmansk to Anadyr.[118] In the United States, relatively small numbers of cruise ships transit in Arctic Alaska waters or undertake shore/community visits in the region.[119]

4. *Norway*

Cruise ships routinely travel to northern Norway[120] and the Svalbard Islands, located high above the Arctic Circle. The number of visitors on oversea cruises to Svalbard has surged from about 30,000 in 2001 to nearly 50,000 in 2007.[121] The number of tourists participating in expedition cruises around Svalbard has risen from about 5,000 in 2001 to over 10,000 in 2007.[122] All expedition cruise ships to Svalbard operate exclusively on distillate fuel, a practice which should be adopted by all other cruise ships travelling to the region.[123]

VI. Trans-Arctic shipping

Nascent trans-Arctic shipping activities also are commencing. In August 2008, the Danish cable ship, *Peter Faber*, sailed through the Northwest Passage.[124] In September of the following year, two German cargo ships completed a commercial voyage from South Korea to the Netherlands via the Northeast Passage.[125] Icebreaker escort requests for Russian Arctic waters have increased to 15 in 2011, up from four in 2010, indicating a growing interest in the Northeast Passage as a permanent new shipping route.[126]

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111 About 225,000 tourists visit Arctic Canada each year. J. Dawson et al., *Climate change, marine tourism, and sustainability in the Canadian Arctic: Contributions from systems and complexity approaches,* 4 Tourism in Marine Environments 69 (2007).

112 J. Dawson et al., Cruise Tourism in Arctic Canada: Community Report for Gjoa Haven, Social Sciences and Humanities – Research Council of Canada, 2011.

113 E. Stewart and J. Dawson, *A Matter of Good Fortune? The Grounding of the Clipper Adventurer in the Northwest Passage, Arctic Canada,* InfoNorth, 64 Arctic 2 (2011).

114 *Id*.

115 *Id*.

116 *See infra* notes 138-39 on ice shelves.

117 A. Sazhenova, *Russia ready to boost Arctic tourism,* BARENTS OBSERVER, Aug. 29, 2011, *available at* http://www.barentsobserver.com/russia-ready-to-boost-arctic-tourism.4953246-16176.html.

118 Kramer, *supra* note 27. The Russian passenger ship *Georg Ots* transited the Northern Sea Route in 2010. Analyse & Strategi AS, Marine Traffic in the Arctic, prepared for the Norwegian Mapping Authority, (2011), *available at* http://www.iho.int/mtg_docs/rhc/ArHC/ArHC2/ARHC2-04C_Marine_Traffic_in_the_Arctic_2011.pdf.

119 U.S. Coast Guard, 2008/09/10 Arctic Activity, *from* Bering Strait Access Workshop, Institute of the North, Aug. 15, 2011, *available at* http://www.institutenorth.org/calendar/events/bering-strait-access-workshop/; *Arctic countries unprepared for cruise ship accidents: officials,* CBC NEWS, June 3, 2008, *available at* http://www.cbc.ca/news/story/2008/06/03/arctic-cruise.html (noting that in summer 2008 at least seven cruise ships carrying over 3,000 passengers scheduled visits to the northern Bering Sea and other Arctic Alaska waters).

120 North Cape, Norway alone is thought to attract 200,000 visitors a year. http://www.skarsvag.no/information/sights/north-cape.

121 A. Evenset and G. Christensen, *Environmental impacts of expedition cruise traffic around Svalbard,* prepared for Association of Arctic Expedition Cruise Operators, Akvaplan-niva AS Report: 4823-1, 9, 2011, *available at* http://www.aeco.no/documents/Finalreport.pdf. To clarify, overseas cruise passengers to Svalbard generally embark from mainland Europe on larger cruise ships, carrying up to 2500 passengers, while expedition cruise ship passengers generally fly into Svalbard and board smaller cruise vessels, typically 70-100 passengers, where they go on excursions to various island locations.

122 *Id*.

123 *Id*.

124 Kingdom Strategy, *supra* note 27, at 19.

125 N. Jameson, *Ships Complete North East Passage,* London News Desk, SUSTAINABLESHIPPING.COM, Sept. 14, 2009.

126 Bruckner-Menchelli, *supra* note 78.

There has been debate regarding whether trans-Arctic liner routes would be economically viable in the near-, medium-, and long-term. Naturally there are several different factors at play (e.g., infrastructure, fuel prices, regulations, and fees).[127] Nonetheless, several studies have found that the polar route can be profitable. One recent study determined that — with reduced ice-breaking fees, even in the near term — voyages utilizing the Northern Sea Route can compete economically with transits through the Suez Canal.[128] Another study, undertaking an economic analysis of a model ship schedule between Shanghai and Hamburg, found that "the Northern Sea Route is a viable alternative to the Royal Road [Suez Canal Route] for container transport."[129] A number of other reports indicate that container transport through the Northern Sea Route can be economically feasible as well.[130]

With regard to actual shipment projections, a recent study found that part-year Arctic transits between Asia and Europe along the Northern Sea Route would result in the potential transport of about 1.4 million twenty-foot equivalent units[131] in 2030 and 2.5 million TEUs in 2050.[132] Dr. James Corbett has projected even greater Arctic shipping activity, estimating that two percent and five percent of global seaborne traffic would divert through the Arctic in 2030 and 2050, respectively.[133]

Additional factors may also make the Arctic route more enticing to shippers. Despite recent construction to enable the Suez Canal to accommodate larger ships, a threshold will inevitably be met in which the size and weight of larger ships will limit the number of ships in each convoy, thereby increasing wait times and cost.[134] Moreover, the Arctic is not burdened by the threat of piracy that impacts waters off the Horn of Africa and the Suez Canal as well as the Straits of Malacca,[135] which among other concerns increases insurance premiums.[136]

VII. Risks related to Arctic shipping

A. Severe environmental conditions associated with Arctic operations

The onset of increased commercial activities, including from polar shipping, poses serious environmental risks, particularly with regard to a bunker or cargo spill. It should be underscored that, while sea ice as a whole is diminishing, its fragmentation will likely lead to increased ice movement and variability in certain areas of the Arctic (e.g., Canadian Arctic).[137] Especially concerning is the increased movement of older, thicker sea ice, which previously was relatively immobile, and the

127 "Whether or not the route [NSR] becomes commercially viable will depend a lot on whether Russia reduces this [icebreaker] fee," maritime analyst Joshua Ho, from Singapore's Nanyang Technological University, informed the news provider. N. Jameson, *Arctic ice melt could hit Singapore's maritime sector,* London News Desk, SUSTAINABLESHIPPING.COM, Aug. 5, 2011.

128 M. Liu and J. Kronback, *The potential economic viability of using the Northern Sea Route (NSR) as an alternative route between Asia and Europe,* 18 J. Transp. Geogr. 434 (2009).

129 J. Verny, Container Shipping on the Northern Sea Route, International Transport Forum, Transport for a Global Economy: Challenges and Opportunities in the Downturn, Forum 2009, 26-29 May, Leipzig, Germany (2009), *available at* http://www.internationaltransportforum.org/2009/pdf/PrizeVerny.pdf.

130 *See* S. Chernova and A. Volkov, Economic feasibility of the Northern Sea Route container shipping development, Logistics and transport, BE 303E 003, master's thesis (2010), *available at* http://brage.bibsys.no/hibo/bitstream/URN:NBN:no-bibsys_brage_12701/1/Chernova.pdf; L.P. Lammers, The Possibilities of Container Transit Shipping via the Northern Sea Route — Using Backcasting to Gain Insight in the Paths that Lead to a Feasible Arctic Shipping Route, Delft University of Technology, "Transport Infrastruc¬ture and Logistics (TIL)," master's thesis (2010), *available at* https://edit.portofrotterdam.com/nl/Over-de-haven/havenontwikkeling/Port-research-centre/Documents/Container-transit-shipping-via-the-northern-sea-route.pdf.

131 The equivalent of about 700,000 containers.

132 Peters et al., *supra* note 38.

133 The study estimates that carbon dioxide emissions from Arctic container traffic in 2030 are 4.8 and 7.7 MMT for a "business as usual" and high growth scenario, respectively; for 2050, the figures would be 12 and 26 MMT. Arctic Emissions Inventory, supra note 36. Paxian et al. (2010) assert 0.73 to 1.28 MMT for fuel consumption in the Northeast Passage in 2050, similar to the 1.78 MMT estimated by Peters et al. (2011) for the same timeframe. A. Paxian et al., *Present-Day and Future Global Bottom-Up Ship Emission Inventories Including Polar Routes,* 44 Environ. Sci. Technol. 1333 (2010).

134 *See* AMSA, *supra* note 22, at 110.

135 According to the International Maritime Bureau, pirate attacks globally increased 36 percent in the first six months of 2011 compared to the same period last year, and attempts to seize vessels off the coast of Somalia hit record highs. *Northern Sea Route,* VOICE OF RUSSIA, Nov. 22, 2011, *available at* http://english.ruvr.ru/2011/11/22/60807981.html.

136 *See Id.*

137 AMSA, *supra* note 22, at 166.

deterioration of glaciers and ice shelves,[138,139] resulting in greater numbers of icebergs, bergy bits, and growlers and a corresponding increase in danger to vessels.[140] Knowledge of ice behavior and characteristics also is limited in many Arctic areas. For instance, trapped ice remains into the summer on Hannah Shoal, off the north coast of Alaska, potentially posing a risk to vessel traffic that frequent the area.[141]

Moreover, other climatic changes expected to occur would make Arctic shipping more dangerous. For instance, an anticipated increase in fog and low-level clouds during the open-water season will elevate the occasions of poor visibility in summer and autumn, when Arctic shipping is at its apex.[142] Diminished visibility not only is a risk factor in accidents but also impairs spill response efforts.[143] Vessel icing is expected to occur more frequently in the Arctic fall, likewise increasing the risk of incident and hampering spill response attempts.[144] Meanwhile, some suggest that Arctic storms could be more severe and/or more frequent during autumn and winter.[145] These storms would increase occurrences of rough seas and high winds,[146] placing further burdens on Arctic vessel navigation and spill recovery operations, generally.

B. Spill response in the Arctic is difficult to impossible

1. *Lack of infrastructure*

Spill response infrastructure and resources are extremely limited in the Arctic.[147] U.S. Coast Guard Rear Admiral Paul Zukunft recently noted "that the nearest Coast Guard response vessel is 1,200 miles away. Whereas thousands of workers flocked to the gulf coast to fight the spill there, there are only a handful of rooms at the tiny Olgoonik Hotel here [in Wainright, Alaska]."[148] Spill response shortcomings are not unique to the American Arctic, but also are evident in most areas of the region.

Spill response in the Arctic also is compromised by severe environmental conditions. Canada's National Energy Board found that, at a minimum, oil spill response measures cannot be utilized in the Arctic's Beaufort Sea 20 percent of the time in June, 40 percent of the time in August, and 65 percent of the time in October.[149]

2. *Mechanical recovery of oil impractical in ice-covered waters*

Furthermore, the availability and effectiveness of oil spill countermeasures in Arctic ice-covered waters are in doubt.[150] Mechanical recovery systems, such as booming

138 By 15 March 2008, 249 icebergs had drifted south of 48º north latitude. By 28 March this had increased to 739. Just one month into the 2008 season more icebergs threatened mariners (and oil rigs) near the Grand Banks than from 2004-2007 combined. J. Spears, *The Changing Arctic Ocean Basin Beyond Sovereignty Infrastructure A Realistic View,* Slide 28, Presentation to Sustainable Shipping Conference in Vancouver, CN, Oct. 14, 2011, *available at* http://www.sustainableshipping.com/library/video/speech/481.

139 C. Noronha, *Canadian Arctic nearly loses entire ice shelf,* ASSOCIATED PRESS, Sept. 29, 2011, *available at* http://www.google.com/hosted-news/ap/article/ALeqM5hmhI9NnRZFg6ncM40p_FPKi8ApGw?docId=5d34a245df0d41d99897797b5534ed36.

140 Bergy bits and growlers are smaller pieces of icebergs that are dangerous for navigation because they are difficult to detect. AMSA, *supra* note 22, at 22.

141 R. Spies et al., An Independent Review of USGS Circular 1370: "An Evalution of the Science Needs to Inform Decisions on Outer Continental Shelf Energy Development in the Chukchi and Beaufort Seas, Alaska," prepared for the Pew Environment Group and Ocean Conservancy (2011), *available at* http://www.pewenvironment.org/uploaded-Files/PEG/Publications/Report/USGS-Report-Review-Sept2011.pdf. [hereinafter Independent Review].

142 L. Holland-Bartels and J. Kolak, Chapter 5, *Oil-Spill Risk, Response, and Impact*, 153, *in* An Evaluation of the Science Needs to Inform Decisions on Outer Continental Shelf Energy Development in the Chukchi and Beaufort Seas, Alaska, L. Holland-Bartels and B. Pierce (eds.), USGS Circular 1370, (2011), *available at* http://pubs.usgs.gov/circ/1370/pdf/circ1370.pdf [hereinafter Science Needs Study].

143 *Id*.

144 *Id*.

145 *Id*.

146 *Id*.

147 Retired Admiral Thad W. Allen, National Incident Commander for the coordinated response to the Deepwater Horizon spill, testified before a Senate committee that the Coast Guard has "limited response resources and capabilities" in the event of a major oil spill in the Arctic Ocean. S. Hrg. 111-259, *Strategic Importance of the Arctic in U.S. Policy,* 111th Cong. S. Hrg. 111-259 at 18 (Aug. 20, 2009).

148 S. Mufson, *Pondering impact of drilling off remote northwest Alaska*, WASHINGTON POST, Aug. 16, 2011, *available at* http://www.washingtonpost.com/business/economy/pondering-impact-of-drilling-off-remote-northwest-alaska/2011/07/21/gIQAvup6JJ_story.html.

149 S.L. Ross Environmental Research Limited, Spill Response Gap Study for the Canadian Beaufort Sea and the Canadian Davis Strait, submitted to National Energy Board, Table 8 (2011), *available at* https://www.neb-one.gc.ca/ll-eng/livelink.exe?func=ll&objId=702787&objAction=browse&redirect=3.

150 "… it remains unclear when and where any one of these countermeasures, or countermeasures in combination, will be available under current and future weather, sea state, ice, and light conditions of the

and skimmers, are negatively impacted by the presence of sea ice.[151] "Ice can induce tears in booming, or can clog skimmer systems and prevent them from encountering spilled oil."[152] While recent efforts have sought to improve skimmer performance in polar conditions, oil recovery rates are still underwhelming,[153] prompting one study to recommend that skimmer deployment in the Beaufort Sea concentrate on small oil spills in areas with little ice.[154] Another study found that "[a]vailable estimates from mechanical response in broken ice vary from 1 to 20 percent depending on the degree of ice coverage and if responding during freeze-up or spring break-up… Recent barge trials on the Beaufort Sea demonstrated that even trace amounts of ice (less than 1/10 ice coverage) can cause significantly reduced efficiencies in mechanical recovery."[155] Furthermore, oil trapped under ice is almost impossible to recover.[156]

In addition, mechanical recovery systems require a platform — often consisting of ice-classed support vessels, barges, or tugs — from which they can be deployed.[157] Arctic environmental conditions, as mentioned, can hamper or even preclude the establishment of these recovery platforms. A recent tanker spill in the icy waters off Norway's coast served to affirm the inadequacy of existing response technologies and capabilities in icy waters.[158]

3. *In-Situ burning's efficacy limited in Arctic waters*

Another oil spill countermeasure, in-situ burning, is often viewed as a viable option in ice-covered Arctic waters. However, it has not been thoroughly vetted in real-world conditions and is questionable from an environmental standpoint. Sea ice abundance, particularly in the 30 to 70 percent ice coverage range,[159] and sea ice type can interfere with in-situ burning's efficacy.[160] Also, emulsified oil (containing sea water) and insufficient oil spill thickness inhibit burning.[161] In addition, this countermeasure produces air emissions (including black carbon and various other particles and gases) and residues. Several studies affirm that residue formation from in-situ burning is more likely in the presence of sea ice than in open water.[162] Another study noted that residues from in-situ burning may contain toxic substances, and should be extracted from the marine environment where feasible.[163] The U.S. Geological Service recently summarized that "[r]obust characterization of likely ISB [in-situ burning] air plumes and toxicological testing, especially on potential effects to benthic organisms, of ISB residue are lacking."[164]

Arctic—or whether they will work even if available." Science Needs Study, *supra* note 142, at 130.

151 *Id*.

152 *Id*.

153 V. Broje and A. Keller, *Improved mechanical oil spill recovery using an optimized geometry for the skimmer surface,* 40 Enviro. Sci. and Tech. 7914, (2006); A. Keller and A. Clark, *Oil recovery with novel skimmer surfaces under cold climate conditions,* Proceedings of the International Oil Spill Conference, May 4–8, 2008, Savannah, Georgia (2008), *available at* http://www.iosc.org/ papers/2008%20112.pdf.

154 S.L. Ross Environmental Research Ltd. et al., Beaufort Sea oil spills state of knowledge review and identification of key issues, Environmental Studies Research Funds Report, no. 177, Calgary, Canada (2010), *available at* http://www.esrfunds.org/pdf/177.pdf.

155 Minerals Management Services, Arctic Oil Spill Response Research and Development Program—A Decade of Achievement, (2008) *available at* http://www.boemre.gov/tarprojectcategories/PDFs/MMSArcticResearch.pdf.

156 World Wildlife Fund, Not so fast: Some progress in spill response, but U.S. still ill-prepared for Arctic offshore development—A review of U.S. Department of the Interior: Minerals Management Service's (MMS) "Arctic Oil Spill response research and development program – a decade of achievement", (2009), *available at* http://www.worldwildlife.org/what/howwedoit/policy/WWFBinaryitem16133.pdf.

157 *Id*.

158 *See, e.g.,* Is og kulde gjør oljeoppsamling vanskelig (Ice and cold makes oil collection difficult), TEKNISK UKEBLAD (TECH MAGAZINE), Feb. 21, 2011, *available at* http://www.tu.no/miljo/article280133.ece (Norwegian to English translation via Google Translate).

159 K. Juurmaa, Working Package 4 (WP4)—Environmental Protection and management system for the Arctic, *in* ARCOP Final Report, GROWTH Project GRD2- 2000-30112, Aker Finnyards Inc., (2006), *available at* http://uscg.twiki.net/do/viewfile/PolarOperations/ReferenceMaterial-EnergyIssues?rev=1;filename=ARCOP_Final_Report.pdf.

160 Independent Review, *supra* note 141, at 134.

161 WWF, *supra* note 156, at 5.

162 M. Fingas, Weather windows for oil spill countermeasures, Prepared for Prince William Sound Regional Citizens' Advisory Council, (2004); I. Buist et al., *Tests to determine the limits to in situ burning of thin oil slicks in brash and frazil ice*, Proceedings of the 26th Arctic and Marine Oil Spill Program Technical Seminar, Environment Canada, Ottawa, Ontario, June 10-12, 2003, (2003), *available at* http:// www.boemre.gov/tarprojects/452/452ab.pdf.

163 Nuka Research and Planning Group, LCC, and Pearson Consulting, LCC, Oil spill prevention and response in the U.S. Arctic Ocean—Unexamined risks, unacceptable consequences, Report to the Pew Environment Group, (2010), *available at* http://www.pewtrusts. org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/PEW-1010_ARTIC_Report.pdf.

164 Science Needs Study, *supra* note 142, at 136.

4. *Dispersant use unproven in Arctic marine environment*

Dispersants also are considered a potential oil spill countermeasure in ice-covered Arctic waters. Dispersants are designed to facilitate the mixing of spilled oil within the water column, thereby reducing the threat of shoreline contamination. However, this naturally "increase[s] the potential exposure of water-column and benthic biota to spilled oil."[165] Moreover, one study has shown that some dispersants are affected by temperature and salinity, and that measured efficacy can fluctuate by about a factor of 10 or more.[166] Overall, the U.S. Geological Service has expressed reservations about its deployment in the region, stating that "substantial scientific and technical work as outlined by various expert groups still must be done before dispersants can be considered a practical response tool for the Arctic."[167] A recent DNV study further asserts that the remote nature of the region leads to slow spill response start-ups that "more or less exclude chemical dispersion techniques due to the short time window of opportunities of chemical dispersion of spills (HFO)."[168] The environmental organization World Wildlife Fund characterizes dispersants as of little value when oil is spilled in shallow waters or at the shoreline and believes its use as a viable response option in Arctic Alaska waters "is still many years off."[169]

Concerns also exist about dispersants' effect on Arctic marine organisms. Contemporary scientific reviews illustrate that there is no consensus regarding dispersant impact on the biodegradation or toxicity of spilled oil.[170] The U.S. Geological Survey recently remarked that "understanding of the potential toxicological effects of dispersants on Arctic ecosystems is lacking."[171] A University of West Florida study even found that extensive Corexit dispersant use in the Deepwater Horizon response could be more damaging to the environment than the oil itself.[172] Finally, a recent report by the environmental organization Earthjustice identified 57 chemical ingredients eligible for use in dispersants at the time of the Deepwater Horizon disaster. Out of all the chemicals, five were associated with cancer, 11 were suspected or potential respiratory toxins, eight were known or suspected to be toxic to marine biota, and five were suspected to have a moderate acute toxicity to fish.[173]

Hence, it would seem prudent to take every effort to ensure that spills from vessels do not occur in Arctic seas and, if they do occur, to minimize the extent of environmental harm stemming from those incidents.

VIII. Minimizing the risk of accidents and spills in the Arctic

Efforts to prevent the occurrence of accidental oil spillage into marine waters as well as mitigate the extent of harm in the event of a spill are essential considerations in minimizing the environmental risk of Arctic shipping. The following section discusses options related to these goals, including ice-strengthened hulls, bunker tanker protections and placement, and fuel choice. While the first two elements are critical in attempting to avoid a fuel discharge, they are not fail-safe; therefore, the last element, the type of fuel bunkered, should not be undervalued, as it can be instrumental in assuring that a spill does not become an environmental catastrophe.

Strengthened hulls are one important aspect in confronting the threat posed by ice to vessels in the Arctic. In 2006, the International Association of Classification Societies, through its "Unified Requirements for Polar

165 National Research Council, Oil spill dispersants— Efficacy and effects: Washington, D.C., National Academies Press, (2005).
166 A. Lewis and P. Daling, A review of studies of oil spill dispersant effectiveness in Arctic conditions (JIP Project 4, Act. 4.11), SINTEF Materials and Chemistry, Oil in Ice – JIP Report No. 11, (2007), *available at* http://www.sintef.no/project/JIP_Oil_In_Ice/ Dokumenter/publications/JIP-rep-no-11-Dispersant- Effectiveness-in-Arctic-Conditions-150207.pdf.
167 Science Needs Study, *supra* note 142, at 137.
168 DNV Heavy Fuel Report, *supra* note 37, at 40.
169 WWF, *supra* note 156, at 5, 12.
170 Science Needs Study, *supra* note 142, at 139.
171 *Id*.
172 N. Bruckner-Mencheli, *Spill Seekers, in* Sustainable Shipping magazine edition on the Polar Code, (2011).
173 Earthjustice, The Chaos of Clean-up, (2011), *available at* http://earthjustice.org/features/the-chaos-of-clean-up.

Ships," standardized global ice classification specifications. In the Unified Requirements there are seven different polar classes, with each level offering different capabilities for polar navigation.[174] Within the Code, new vessels operating in polar waters should be Polar Class 7 at a minimum. Stringent ice-strengthening requirements must also be considered for existing vessels, as well.

Much can also be accomplished, in terms of reducing the chance of a spill, through double hull protection around bunker and cargo tanks as well as size restrictions and prudent placement of those tanks aboard the vessel.[175] In addition, the incorporation of standardized equipment aboard vessels can serve to contain pollutants in the event of an accident and prevent their escape into polar waters and to facilitate efficient and expeditious salvage.[176]

Another key way to minimize the environmental impact from a spill is to ensure that vessels are burning marine distillate (e.g. marine gas oil, marine diesel oil) as opposed to heavy fuel oil.[177] When spilled, lighter, more refined marine fuels naturally disperse and evaporate much more quickly than HFO.[178] Tests have shown that weathering can break down marine diesel in approximately three days, whereas over 90 percent of HFO by mass persisted even after 20 days in the water.[179,180] Marine distillate fuels also generally do not emulsify, in contrast to HFOs, which after three to five days emulsify to the maximum water content (40 to 80 percent), significantly increasing the volume of oil to be recovered.[181] A recent DNV study concluded that "the consequences of HFO spills are likely to be more severe than spills of marine diesels" and that "significant risk reduction will be achieved if the onboard oil type is of distillate type rather than HFO."[182] The DNV study found, as well, that over 70 percent (167 out of 237) of the large vessels (5,000 gt and above) operating in the Arctic used HFO.[183] These larger vessels can hold substantial quantities of fuel for propulsion purposes[184] and also presumably would be travelling with full bunker tanks since fueling options in the region are limited. Again, the actual number of vessels burning HFO in the Arctic is likely higher as the DNV study period only tracked vessels between August and November 2010.[185]

In general, all vessels can run on distillate fuel. A small minority of vessels may require some modifications in order to operate on distillate;[186] however, these modifications tend to be insubstantial.[187]

IX. Importance of strong Polar Code requirements

A. Accidents in the Arctic

With the current level of shipping activity in the Arctic, shipping accidents are relatively common. From 1995 to 2004, nearly 300 accidents and incidents occurred in the region.[188]

Vessel-related spills involving oil or marine fuel have significantly impacted the Aleutian Islands over the

174 *See* http://www.iacs.org.uk/document/public/Publications/Unified_requirements/PDF/UR_I_pdf410.pdf.

175 K. Michel and T. Winslow, *Cargo Ship Bunker Tanks: Designing to Mitigate Oil Spillage,* prepared for SNAME conference, Joint California Sections Meeting, (1999), *available a*t http://www.sname.org/Home/.

176 *See generally* France, *Proposal for inclusion of a chapter on environmental protection in the mandatory code,* (Jan. 28, 2011) (submitted to IMO's Design and Equipment Subcommittee and reviewed as DE 55/12/13) and relevant technologies at www.maritimepassivesafety.com.

177 Consistent with DNV Heavy Fuel Report, *see supra* note 37, the term heavy fuel oil in this study denotes residual marine fuel or mixtures containing predominately residual fuel and some distillate fuel, such as intermediate fuel oil.

178 Evenset and Christensen, *supra* note 121, at 4-5.

179 DNV Heavy Fuel Report, *supra* note 37, at 38-39.

180 Cold temperatures, lack of sunlight, and ice cause oil to persist longer in arctic environments than in more temperate locations.

181 DNV Heavy Fuel Report, *supra* note 37, at 38-39.

182 *Id*.

183 *Id*. at 30.

184 Panamax containerships, bulk carriers, and tankers can carry 5,600m^3, 2,600m^3, and 1,700m^3 of HFO, respectively. K. Michel and T. Winslow, *supra* note 175, at 5.

185 DNV Heavy Fuel Report, *supra* note 37, at 1; *see also* AMSA for year-round data in 2004.

186 Eighty-seven percent of companies reported to CARB that none of their vessels visiting California would require modifications. Additionally, CARB noted that "overall survey data significantly overestimates the need for ship modifications." CARB, Staff Report on Oceangoing Vessel Fuel Quality Rule, VIII-5, *available at* http://www.arb.ca.gov/regact/2008/fuelogv08/ISORfuelogv08.pdf.

187 N. Jameson, *Conversion will bring the icebreaker into line with EPA requirements*, London News Desk, SUSTAINABLE-SHIPPING.COM, Oct. 24, 2011.

188 AMSA, *supra* note 22, at 86; *see also* Table 1.

Marine incidents involving polar cruise ships			
Marine incidents	Total events	Events since 2000	Percent since 2000
Polar cruise ships sunk, 1979-2007	8	5	63%
Polar cruise ships running aground, 1972-2007	27	16	59%
Pollution and environmental violations, 1992-2007	40	18	45%
Disabling by collisions, fires, propulsion loss, 1979-2007	28	22	79%
Source: Harold Hunt (USCG), *Raising the Ante: Mass rescue operations in the Arctic*, Proceedings Magazine (Fall 2011)			

Table 1: Polar cruise ship incidents

past 20 years. In 1997, an accident involving the *M/V Kuroshima* released approximately 40,000 gallons of heavy fuel oil into the Bering Sea.[189] In December 2007, the *M/V Selendang Ayu* grounded and broke up near the coast, resulting in six fatalities and the spilling of 336,000 gallons of heavy fuel oil.[190] According to the U.S. Transportation Research Board of the National Academies, these events "can have serious negative impacts on the region's ecosystem, devastating endemic and migrating wildlife and plant species and the economies that depend on the region's rich resources."[191]

Recently, there has been a spate of incidents in the Canadian Arctic. In August 2010, the expedition cruise ship *Clipper Adventurer* stranded itself on an escarpment in Coronation Gulf.[192] The same month, the oil tanker *Mokami* ran aground near Pangnirtung, an Inuit hamlet in the territory of Nunavut. The following month, the fuel tanker *MV Nanny* ran aground on a sandbar in Simpson Strait. The vessel was carrying 2.4 million gallons of fuel at the time.[193] Fortunately, no injuries or fuel spillage occurred in any of these episodes; however, these incidents provide an indication of what we can expect in the region in the future and provide incentives for the adoption of reasonable restrictions on vessel operations in the Arctic.

B. Environmental harms from an Arctic oil spill

The Arctic Ocean and peripheral seas support diverse ecosystems and provide critical habitat for whales, walrus, polar bears, seabirds, fish, plants, and smaller organisms, many of which are dependent on the region's salient feature: sea ice.[194] Arctic wildlife has evolved to adapt to the cold weather climate. The Arctic ecosystems have relatively simple food webs and few species — though in high abundance — that tend to live for long periods of time and have low reproduction rates.[195] Many of these species are threatened or endangered.[196]

189 *Id*. at 144.
190 From Special Report 293 "Risk of Vessel Accidents and Spills in the Aleutian Islands", Transportation Research Board of the National Academies, Washington D.C., 19, (2008).
191 *Id*. at 19.
192 Stewart and Dawson, *supra* note 113.
193 N. Bruckner-Menchelli, *Fuel tanker runs aground in Arctic,* Vancouver News Desk, SUSTAINABLESHIPPING.COM, Sept. 2, 2010.
194 Independent Review, *supra* note 141, at 49.
195 DNV Heavy Fuel Study, *supra* note 37, at 143.
196 Pew Environment, fact sheet, Protecting Life in the Arctic, *available at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Fact_

Arctic fox.

Millions of seabirds from over 60 species can be found in the Arctic, such as Steller's and spectacled eiders, Kittlitz's murrelets, terns, auklets, and yellow-billed loons.[197] Arctic waters sustain more than 150 species of fish, including populations of Arctic cod, herring, capelin, sand lance, and several types of cisco and whitefish. These fish, along with crabs, mollusks and krill, constitute the foundation of the Arctic marine food chain.[198]

The World Conservation Union and the Natural Resources Defense Council recently identified 13 ecologically rich and vulnerable areas in the Arctic Ocean that warrant special protection as summer sea ice melts and industrial activity expands in the region.[199]

Sheets/Protecting_ocean_life/Factsheet%20-%20Safeguarding%20 Arctic.pdf.

197 *Id*.

198 *Id*.

199 The report reflects the findings of 34 leading scientists and representatives of indigenous communities in Arctic countries who gathered at a Scripps Institution of Oceanography workshop in 2010. IUCN/NRDC, Workshop to Identify Areas of Ecological and Biological Significance or Vulnerability in the Arctic Marine Environment, Nov. 2-4, 2010, *available at* http://data.iucn.org/dbtw-wpd/edocs/Rep-2011-001.pdf.

In the event of an oil spill, wildlife is exposed to petroleum toxins through fumes (e.g., volatile organic compounds and polycyclic aromatic hydrocarbons),[200] ingestion and direct contact with the spilled substance. Oil on sea birds and marine mammals, such as eiders, polar bears, and seals, compromises their feathers and fur, which can lead to hypothermia and death.[201] Aside from mortality, sub-lethal effects from toxic exposure include loss of fertility and metabolic disorder.[202] An oil spill's negative impact may be heightened for Arctic

200 The toxicity of PAHs can increase significantly when exposed to sunlight, which can extend nearly 24 hours in the Arctic summer. *See*, M. Barron, Potential for Photoenhanced Toxicity of Spilled Oil in Prince William Sound and Gulf of Alaska Waters, prepared for Prince William Sound Regional Citizens' Advisory Council, (2000), *available at* http://www.pwsrcac.org/docs/d0002100.pdf.

201 AMSA, *supra* 22, at 136.

202 Independent Review, *supra* note 141, at 51.

species, due to their longetivity and slow reproductive rates, possibly prolonging population level effects.[203]

Arctic wildlife is particularly susceptible to oil spills for additional reasons. In the region, animals tend to use leads, or ice free channels, as well as congregate in large numbers within polynyas — open water areas surrounded by ice — to breed, nest, and rear young at certain times and locales each year.[204] Moreover, current Arctic spill response practices seek to concentrate oil into open water areas for in-situ burning or mechanical recovery, thereby imperiling mammals emerging to breathe and adversely affecting the food chain.[205] In addition, the impracticability of cleaning up an oil spill in the Arctic, especially oil trapped under ice, could lead to oil persistence in affected areas, consequently causing uptake of oil in marine and coastal food chains.[206]

C. Impacts on Indigenous Peoples from an Arctic oil spill

The environmental and social threats posed by a vessel spill in the Arctic are immense, particularly since, in places like the Bering Strait area, "human reliance on marine resources for subsistence remains essential."[207] Presently, there are no established vessel routing measures in the Strait. Further, there is no Vessel Traffic Service or other traffic management system in operation, coverage of vessels' automated identification system is not comprehensive, and shore-based very high frequency FM communication services are nonexistent. Also, there are only three U.S. Coast Guard maintained navigational aids in the Strait, and none above Kotzebue Sound.[208] Safe navigation in the region, due to the absence of designated routes and few aids, is complicated by the threat of sea ice. It is present in the area most of the year, and dangerous multi-year ice from the Arctic ice pack has been known to flow southward through the Strait and into the Bering Sea.[209]

A spill in an area such as the Bering Strait would negatively impact a broad range of wildlife. Cetaceans and pinnipeds would be adversely affected. Major populations of nesting shorebirds, waterfowl, and other birds that utilize habitat along the coastal Beaufort and Chukchi seas and along the coast of western Alaska would also be imperiled. In addition, a spill could drift ashore to western Alaska areas and impair seasonal herring and salmon fisheries.[210]

A harmful spill would be especially detrimental to St. Lawrence Island communities in Gambell and Savoonga, where 95 percent of subsistence harvests are from marine-based resources. Communities on Shishmaref, Sarichef Island, and Wales, and on the mainland, also depend extensively on marine resources.[211] A sizeable spill, of course, would also adversely impact all local populations in the Bering Strait region.

D. Ancillary benefits of switching to distillate—reductions in harmful air emissions

Air pollution from diesel engines, including those aboard vessels, is a major source of harmful fine particulate emissions. Exposure to particulate matter is the subject of thousands of medical studies. These studies have linked particle exposure to morbidity and mortality, including death due to lung cancer and cardiopulmonary disease such as strokes and heart attacks. In children, particulate matter has been correlated with asthma onset and asthma attacks, crib death, and lung growth abnormalities. In addition, particulate matter exposure has been associated with decreased lung function, increased respiratory symptoms such as coughing and breathing difficulties, DNA damage, allergy sensitization, and chronic bronchitis. People with lung or heart disease, the elderly, and children are at highest risk from exposure to particulate pollution.[212]

203 *Id*. at 53.
204 *Id*. at 54, 58; AMSA, *supra* 22, at 38.
205 Independent Review, *supra* note 141, at 8.
206 AMSA, *supra* note 22, at 136-138.
207 *Id*. at 108.
208 *Id*. at 109.
209 *Id*. at 106.
210 *Id*. at 147.
211 *Id*. at 107-08.
212 U.S. EPA, Particulate Matter: Health, *available at* http://www.epa.gov/oar/particlepollution/health.html; *see also,* US EPA (2004) Air Quality Criteria for Particulate Matter (2004), Vol I Document No. EPA600/P-99/002aF and Vol II Document No. EPA600/P-99/002bF.

Black carbon is the colored carbonaceous element of particulate emissions and is produced by the incomplete combustion of fossil fuels, biofuels, and biomass.[213] Black carbon emissions, as a component of PM, also adversely affect human health in the manner described above.[214] In addition, black carbon emissions impact climate, especially in the Arctic, as has been described in a number of IMO submissions.[215] In fact, black carbon emissions account for nearly 50 percent of Arctic warming,[216] and incomplete fossil fuel combustion constitutes a significant source of black carbon in the region.[217] While marine shipping in the Arctic is presently a relatively minor source of black carbon emissions,[218] its impact may be great because of proximity to Arctic sea ice and snow.[219] At a 2007 U.S. congressional hearing, one scientific expert remarked that "[r]educing intra-Arctic [black carbon] emissions from generators and *marine vessels* will become increasingly important as industry and transport seek new opportunities in the thawing Arctic."[220] In addition, black carbon emissions in the Arctic are likely to grow as Arctic ice melts and sea lanes open up to increased shipping activity. A recent high-growth scenario of Arctic shipping, including both destinational and diverted trans-Arctic traffic, projects black carbon emissions to exceed 2004 levels by nearly five-fold in 2030 and over 18-fold by 2050.[221] That same high-growth scenario suggests that black carbon from Arctic shipping in 2030 may increase global warming potential of the vessels' emissions by some 17 to 78 percent.[222]

Another recent study indicates that vessel use of distillate fuel rather than bunker fuel reduces air emissions of particulate matter, including black carbon. The study analyzed the emissions of a container vessel as it switched from high-sulfur HFO to low-sulfur distillate fuel and slowed its speed off the California coast.[223] Over 90 per cent reductions of particulate matter, and seventy-five percent reductions in black carbon, were achieved on a per kilometer basis in the demonstration.[224,225] Particulate matter is made up of a number of constituents, including sulfates, particulate organic matter and black carbon. All PM constituents were reduced by at least 75 percent on a per kilometer basis. Observed reductions in sulfate and particulate organic matter were found to be related to the fuel composition. Similarly, the authors posit that "use of higher quality fuels by ships in the Arctic may result in less BC [black carbon] deposition to snow and ice (compared to the use of low quality fuels) resulting in positive climate benefits."[226]

213 V. Ramanathan and G. Carmichael, *Global and Regional Changes Due to Black Carbon,* 1 Nature Geoscience, 221, 221 (2008).

214 *See also* J. Schwartz, Hearing on Black Carbon and Global Warming, Testimony before the House Committee on Oversight and Government Reform Committee, U.S. House of Representatives, The Honorable Henry A. Waxman, Chair, October 18, 2007, *available at* http://oversight-archive.waxman.house.gov/story.asp?id=1550.

215 *See, e.g.,* MEPC 62/4/16 by the Clean Shipping Coalition et al. and related documents identified therein. *Infra* note 229.

216 D. Shindell and G. Faluvegi, *Climate Response to Regional Radiative Forcing During the Twentieth Century*, 2 Nature Geoscience 294 (2009).

217 D. Koch et al., *Global Impacts of Aerosols from Particular Source Regions and Sectors*, 112 Journal of Geophysical Research D02205 (2007); *see* M. Flanner et al., *Present-Day Climate Forcing and Response from Black Carbon in Snow,* 112 Journal of Geophysical Research D11202 (2007) (finding that over 80 percent of the forcing caused by black carbon on snow comes from black carbon from fossil fuels).

218 In 2004, shipping released 1,180 tons of black carbon in the Arctic. AMSA, *supra* note 22, at 141.

219 Arctic Council, Technical Report of the Arctic Council Task Force on Short-Lived Climate Forcers, As Assessment of Emissions and Mitigation Options for Black Carbon for the Arctic Council TS-4, 2011, *available at* http://www.arctic-council.org/index.php/en/environment-a-climate/90-climatechange/172-slcf [herinafter SLCF Report].

220 C. Zender, *Arctic Climate Effects of Black Carbon,* Hearing on Black Carbon and Global Warming, Testimony before the House Committee on Oversight and Government Reform Committee, U.S. House of Representatives, The Honorable Henry A. Waxman, Chair, October 18, 2007, at 6. (emphasis added), *available at* http://oversight-archive.waxman.house.gov/story.asp?id=1550.

221 Arctic Emissions Inventory, *supra* note 36.

222 *Id*.

223 D. Lack et al., *Impact of Fuel Quality Regulation and Speed Reductions on Shipping Emissions: Implications for Climate and Air Quality,* 45 Environ. Sci. Technol. 9502 (2011), *in* United States, *Impact of fuel quality regulation and speed reductions on shipping emissions: Implications for climate and air quality* (Nov. 11, 2011) (submitted to IMO's Bulk Liquids and Gases Sub-Committee and reviewed as BLG 16/INF.5) and accompanying synopsis: United States, *Impact on the Arctic of Emissions of Black Carbon from International Shipping* (Nov. 25, 2011) (submitted to IMO's Bulk Liquids and Gases Sub-Committee and reviewed as BLG 16/15/2).

224 *Id*.

225 The majority of black carbon reductions achieved in the study were at¬tributed to switching to a cleaner fuel rather than slowing down. *See* D. Lack, Black Carbon Emissions from Shipping – Effects of Vessel Speed, Ship Speed Limits Seminar, Oct. 4, 2011, *available at* http://www.transportenvironment.org/docs/events/speed_limiters_for_shipping/Lack_BC_Speed_Ships_post.pdf; A. Petzold et al., *Operation of Marine Diesel Engines on Biogenic Fuels: Modification of Emissions and Resulting Climate Effects*, 45 Environ. Sci. Technol. 10394 (2011)(finding nearly 90 percent reductions in black carbon emissions when switching from HFO to marine gas oil).

226 D. Lack et al., *supra* note 223, at E.

In view of the above, a switch from bunker fuel to distillate in the Arctic would substantially reduce total emissions of fine particulate matter ($PM_{2.5}$) in a region of four million people. A recent study from Sweden found that a shift to distillate use in its national shipping industry would reduce $PM_{2.5}$ levels by 150 metric tons in 2020.[227] These reductions were achieved, as well, in a relatively inexpensive manner: 44.5 Euros/kg $PM_{2.5}$.

Moreover, switching to distillate fuel would save many lives and reduce monetized health costs considerably. A recent study by Dr. James Corbett and others estimates that premature mortality in the Arctic front area (above 40 degrees north latitude) from co-emitted black carbon and particulate organic matter from ships is 6,200 persons per year.[228] Monetized costs related to these premature mortalities amount to roughly $39 billion each year.[229] The costs associated with using a cleaner distillate fuel instead of HFO would likely be substantially exceeded by monetized benefits to human health, making the proposal cost-effective from a public policy perspective.

E. Economic benefits of switching to distillate use in the Arctic

Heavy fuel oil spills, due to their persistence and capacity to spread out over large areas, are costly in terms of cleanup and socioeconomic and environmental damages. Relatively small spills of HFO have resulted in tremendous costs. For example, the *Nakhodka* spilled some 17,500 metric tons of HFO off Japan's coast which resulted in a total cost of over $200 million, while the *Erika* spilled about 20,000 metric tons of HFO in French waters, resulting in overall costs in excess of $300 million.[230] An HFO spill in the Arctic, even one of relatively small size, would likely cost many millions of dollars.[231]

F. Reasons for shipping industry support of a strong Polar Code

1. Harmonizes rules

Currently a number of varied national rules apply to Arctic shipping within the region's exclusive economic zones.[232] One intention of the Polar Code is to harmonize and strengthen the regulatory framework for shipping on a pan-Arctic basis. However, if the Code is found lacking, Arctic countries are apparently prepared to pursue other courses of action. For example, the Kingdom of Denmark has remarked:

> *Should it prove that agreement on global rules cannot be reached, and in view of the especially vulnerable Arctic environment and the unique challenges of security, the Kingdom will consider implementing non-discriminatory regional safety and environmental rules for navigation in the Arctic in consultation with the other Arctic states and taking into account international law, including the Convention on the Law of the Sea provisions regarding navigation in ice covered waters.*[233]

Enacting a strong Code with the global imprimatur of the IMO, however, would avoid the need to pursue an Arctic regional agreement with other coastal states. Moreover, adopting environmental provisions for the Arctic that are comparable to rules already in place in

227 SLCF Report, *supra* note 219, at 6-13.

228 Clean Shipping Coalition, *Updated study estimating premature mortality above 40 degrees north latitude resulting from primary particulate emissions from international shipping activity* (May 6, 2011) (submitted to IMO's Marine Environment Protection Committee and reviewed at MEPC 62/INF.32).

229 Clean Shipping Coalition et al., *Reduction of emissions of Black Carbon from shipping in the high northern latitudes* (May 6, 2011) (submitted to IMO's Marine Environment Protection Committee and reviewed at MEPC 62/4/16).

230 I. White and F. Molloy, *Factors that Determine the Cost of Oil Spills, The International Tanker Owners Pollution Federation Limited,* 3, 5 (2003), *available at* http://www.itopf.com/_assets/costs03.pdf.

231 Models identifying the trajectory, fate, biological effects, and other impacts of spilled oil and fuels (*see* SIMAP *available at* http://www.asascience.com/) as well as the relative cost-effectiveness of alternative spill response measures (*see* Development of the Oil Spill Response Cost-Effectiveness Analytical Tool, Proc. of 28th Arctic and Marine Oilspill Program Technical Seminar, (2005)), can provide more refined Arctic spill cost estimates.

232 Rothwell and Joyner, *supra* note 45, and Brubaker, *supra* note 23. *See also* E. Franckx, *The Legal Regime of Navigation in the Russian Arctic*, 18 J. of Transnational Law & Policy 327 (2009)

233 Kingdom Strategy, *supra* note 27, at 18.

the Southern Ocean provide not only enhanced environmental protection but also create a more equitable playing field.

2. Provides certainty for investment decisions

Without rules that govern Arctic shipping, investment decisions such as vessel and infrastructure purchases relevant for the region are difficult to make. However, clear guidance can enable responsible commercial activities to follow accordingly.

3. Protects the environment and fosters sustainable development in the region

A strong Code will enhance crew and passenger safety as well as better safeguard the vulnerable Arctic environment. Since a bunker or cargo spill represents an acute threat to the marine environment and indigenous activities, mitigation of this risk is imperative.[234] As detailed in this report, sufficient ice-strengthening requirements for vessel operations in the Arctic are essential, but reducing environmental risk by other means should be pursued. Primarily, HFO should not be used within the Arctic bounds of the Polar Code.[235] A ban on HFO use would provide important environmental risk mitigation. First order protections, i.e. ice-strengthened hulls and double skinned bunker tanks, cannot prevent all spills from occurring. Groundings or allisions with ice, especially glacial ice and old sea ice, can and do rupture bunker tanks and cause spills into marine environments, even with strong preventative measures in place.[236] The *Explorer* sinking in the Southern Ocean is a good example of an ice-strengthened vessel whose tanks were compromised when it struck ice, yet the level of environmental harm was substantially mitigated because the vessel operated on marine distillate as opposed to HFO.[237]

In addition to the inherent marine environmental benefits related to an HFO use ban, air quality benefits accrued from mandating the use of low-sulfur marine fuel would be substantial.[238] Further, from a cost-benefit standpoint, eliminating HFO use would provide significant health cost savings.[239] Finally, a strong Polar Code enacted by the IMO would send a clear and unambiguous signal to interested parties and intergovernmental fora that commercial activities in the Arctic should proceed in an environmentally sustainable manner.

4. Obviates the imposition of an extremely burdensome regulatory regime

A major vessel cargo or bunker spill in the Arctic could alter the growth of shipping in the region. If a spill occurred either before the Polar Code entered into force or after implementation of weak amendments, it is possible that, depending on the spill's severity, a revision of the Code would be undertaken. In that case, it is quite likely that political pressure would cause member nations to advocate for bans on shipping in areas of the Arctic and/or re-craft the Code with extremely onerous environmental and safety standards, effectively making certain types of shipping in the region economically infeasible. As evidence of this potential scenario, one need only look to responses following oil spill disasters involving the *Exxon Valdez*, *Prestige*, and *Erika*, where domestic and/or IMO action was swift and forceful.[240] Moreover, insurance costs associated with Arctic shipping, in light of a major spill, could increase substantial-

234 *See* AMSA, *supra* note 22, at 5, 7.

235 Moreover, carriage restrictions for heavy-grade oil should be considered for certain Arctic waters exhibiting special ecological and cultural characteristics.

236 Michel and Winslow, *supra* note 175; Republic of Liberia, Decision of the Commissioner of Maritime Affairs, R.L. And the Report of Investigation in the Matter of Sinking of Passenger Vessel Explorer (O.N. 8495) 23 November 2007 in the Bransfield Strait near the South Shetland Islands, published by the Bureau of Maritime Affairs, Monrovia, Liberia (2009), *available at* http://www.cruisejunkie.com/Explorer%20-%20Final%20Report.pdf.

237 *Id*.

238 *See e.g.*, IMO submissions BLG 11/INF.3, BLG 12/6/9, BLG 15/INF.5, MEPC 52/4/4, MEPC 53/4/1, MEPC 57/4/15, MEPC 62/4/3, and MEPC 62/INF.32 (estimating that international shipping emissions of particular organic matter and black carbon will be responsible for approximately 6,200 premature deaths in 2012 in the northern hemisphere above 40° North latitude).

239 For instance, the California Air Resources Board has calculated that its ocean-going vessel fuel rule would result in monetized health benefits, related only to directly emitted particulate matter, of nearly 10 to 1. CARB, Appendix G, Calculation of Total Present Value Cost of the Regulation, *available at* http://www.arb.ca.gov/regact/2008/fuelogv08/appgfuel.pdf.

240 *See* J. Roberts et al., *The Western European PSSA proposal: A "politically sensitive sea area"*, 29 Marine Policy 431 (2005).

ly, possibly affecting the economic calculus that governs vessel operations.

G. Added reason for Arctic coastal state support of a strong Polar Code: enacting a weak Polar Code could inhibit actions taken by Arctic coastal states under article 234 of UNCLOS

An international law expert has asserted that a binding Polar Code would limit the regulatory authority of coastal states to adopt navigational safety and environment rules in ice-covered waters under article 234 of the United Nations Convention on the Law of the Sea (UNCLOS).[241] The assessment is based on the general inclination of UNCLOS — outside of state internal waters — to limit coastal state jurisdiction so that navigation consonant with generally accepted international standards or rules can occur without impairment; the principle of freedom of navigation espoused in article 234; and a reading of that article "in light of the subsequent development of and reliance on standards adopted by the IMO."[242] The expert maintains that adoption of a weak Polar Code would handcuff countries such as Norway from exercising article 234 authority that was more stringent than the Code.[243]

X. Conclusion

In light of the information and reasons presented above, an environmentally strong Polar Code is in the best interests of all. Of particular importance, the Code should contain stringent ice strengthening requirements for vessels plying polar waters and prohibit the use of heavy fuel oil by vessels transiting Arctic waters. With these key provisions in place, Arctic shipping would be headed in the right direction from an environmental and safety standpoint. As discussions surrounding the specifics of Polar Code provisions enter a more mature phase in 2012, particularly with respect to environmental provisions, we ask that all stakeholders seriously consider this report in Code deliberations.

241 O. Fauchald, *Regulatory Frameworks for Maritime Transport in the Arctic: Will a Polar Code Contribute to Resolve Conflicting Interests?*, 83, *In* Marine Transport in the High North, J. Grue and R. Gabrielsen (eds.), The Norwegian Academy of Science and Letters and The Norwegian Academy of Technological Sciences, (2011).

242 *Id*.

243 *Id*.